

Report on
Verification Measures –
Near-Term Technical Steps



International Security Advisory Board

November 6, 2012

Disclaimer

This is a report of the International Security Advisory Board (ISAB), a Federal Advisory Committee established to provide the Department of State with a continuing source of independent insight, advice and innovation on scientific, military, diplomatic, political, and public diplomacy aspects of arms control, disarmament, international security, and nonproliferation. The views expressed herein do not represent official positions or policies of the Department of State or any other entity of the United States Government.



United States Department of State

Washington, D.C. 20520

November 6, 2012

MEMORANDUM FOR ACTING UNDER SECRETARY GOTTEMOELLER

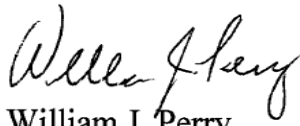
**SUBJECT: Final Report of the International Security Advisory Board (ISAB) on
Verification Measures – Near-Term Technical Steps**

I am forwarding herewith the ISAB's report on Verification Measures – Near-Term Technical Steps. The report responds, in part, to former Under Secretary Ellen Tauscher's request of July 5, 2011, that the Board undertake a study on strategic deterrence and the path to a world of mutual assured stability. Additional reports also address this study topic. The report was drafted by members of a Study Group chaired by Dr. Graham Allison. It was reviewed by all ISAB members and unanimously approved by October 17, 2012.

In a meeting with Dr. Allison's Study Group on November 4, 2011, former Under Secretary Tauscher asked specifically for ideas related to verification on which the United States could engage with Russia in the near term, in order to build trust and continue making progress on arms control preliminary to future negotiations on nuclear arms reductions. The report therefore describes some achievable transparency measures that could be undertaken in the near term with Russia, which would promote the transformation of our nuclear relationship toward mutual assured stability. The report also highlights what has been achieved bilaterally so far in research on nuclear weapons monitoring and verification technology.

The report proposes several new transparency measures that the United States and Russia could undertake, including reciprocal visits to a variety of nuclear weapons enterprise sites, a joint facility designed for joint development and demonstration of nuclear weapons and fissile material measurement systems; and reaching agreement on a jointly certified radiation measurement system for detecting nuclear weapons while not revealing classified information.

We encourage you to consider all of the report's recommendations carefully. The Board stands ready to brief you and other members of the Administration on the report.

A handwritten signature in black ink, appearing to read "William J. Perry". The signature is fluid and cursive, with the first name "William" and last name "Perry" clearly distinguishable.

William J. Perry

Chairman

International Security Advisory Board

INTERNATIONAL SECURITY ADVISORY BOARD

Report on Verification Measures – Near-Term Technical Steps

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Report on Verification Measures – Near-Term Technical Steps¹

TASKING. The International Security Advisory Board (ISAB) was asked to undertake a study of how the United States could pursue and manage a transition from a world of mutual assured destruction to a world of mutual assured stability.

Achieving an end state of mutual assured stability requires a dramatic change in the relationship among nations. This change will likely take many years (or decades). A current focus of this transition is changing our relationship with Russia, one that is burdened with decades of mistrust during the Cold War. While modest progress has been made along this path, the next major steps could take years (e.g., moving beyond the New START Treaty). A key question is whether there are less ambitious, achievable transparency steps in the near term with Russia that promote a transformation of our nuclear relationship and build momentum toward the desired end state? In particular, what are the current and developing technology opportunities that can build trust? Further development of a trusting relationship should help enable more ambitious steps.

Monitoring and verification of U.S.-Russia agreements on nuclear weapons is ripe for near term progress. Monitoring provides data and information in a timely manner, for national security purposes with regard to the other's intentions, commitments and obligations, while verification of compliance is a determination of whether activities of another are within the bounds established by the limitations and obligations of the agreement or treaty.

The overarching technical problem for many current and future nuclear weapons agreements revolves around the identification of the material in a closed container

¹ While all ISAB members have approved this report and its recommendations, and agree they merit consideration by policy-makers, some members do not subscribe to the particular wording on every point.

as a warhead, a weapon component, or fissile material from production or a dismantled nuclear weapon. Material identification R&D was somewhat rejuvenated after the end of the Cold War with the potential for new treaties as well as the goal of accounting for special nuclear materials (SNM) throughout the world. The events of September 11, 2001, accelerated the need for new detectors and in particular broadened the need for technologies that could find hidden SNM in a variety of environments, though there remain fundamental technical limitations on the capabilities of such detectors. This technical effort has been applied in a number of transparency activities – e.g., the Highly Enriched Uranium (HEU) Purchase Agreement, the Trilateral Initiative, the Plutonium Production Reactor Agreement (PPRA), and Mayak Transparency.

Further complicating the problem is that some or all of the information concerning the material in the container is considered classified by at least one party to the agreement. We must provide confidence in the veracity of the other party's treaty declaration while not revealing classified information. We also must be able to confirm independently, without access to the material, that an object in a sealed container is in fact a nuclear component, and the converse, that a sealed container does not contain a nuclear component.

Technology exists to measure an object for the presence of nuclear material **IF** close-in, long dwell time access is permitted as could be in a cooperative activity or treaty with Russia. A variety of active and passive methods have been considered and are currently in various stages of development. These include active neutron interrogation, passive neutron and gamma spectral measurements, and nuclear imaging. The greatest remaining challenge is to provide confidence that declarations concerning items in a nuclear-weapon arms control regime are true, while not revealing classified information, within the allowed access and time constraints.

Two fundamentally different approaches have been considered that include information barriers to protect sensitive information. The attribute approach is based on the intrinsic characteristics of nuclear weapons and their components. The associated procedures are simpler as they do not require a classified database. The template approach compares the radiation signature from an inspected item with a known standard for a weapon or component of the same type. Template

comparisons are the only practical solution if the objective is demonstrating that two or more weapons or components are of the same type. Both approaches – the centerpiece of technology R&D for several years – have been investigated in parallel with treaty negotiations. The arms control treaty dictates which verification method is most appropriate.

Significant effort has been undertaken to demonstrate to Russia and the International Atomic Energy Agency the feasibility of integrating information barriers into radiation measurement systems. For example, attribute measurement systems incorporating information barriers were demonstrated for a U.S.-Russia-International Atomic Energy Agency audience in June 1999 and for a U.S.-Russia audience in August 2000. In addition, the concept was part of the Plutonium Production Reactor Agreement Workshop in November 2000.

A more ambitious goal beyond such a measurement system would be to have sufficient visibility into each country's full nuclear enterprise to adequately track nuclear material. This could encompass the continuous tracking of nuclear material during each stage of its "life" from production to component fabrication, warhead assembly, deployed and nondeployed weapons, dismantlement, and material disposition.

A possible additional trust-building measure is the reciprocal visit of further sites in each country's nuclear enterprise. These could include sites such as Savannah River, Y-12, Los Alamos National Laboratory (LANL) (TA-55 and CMR), Nevada Test Site (NTS – now the Nevada National Security Site, NNSS), and Pantex (and their Russian equivalents). While care must certainly be taken to avoid unintentionally revealing classified information, observing the level and type of activity and the size of these facilities where operational activity occurs can reduce uncertainty and build confidence.

The major areas of consideration for these applications to full nuclear enterprise transparency include warhead and special nuclear material identification based on radiation detection discussed above, warhead and material monitoring, tamper-indicating devices such as tags and seals, and technological alternatives to radiation detection. Different technologies and accompanying procedures need to

be developed to support measurement instrumentation ranging from field size, point-of-use equipment to large stationary installations.

For all of these technical activities, joint development and testing is crucial for trust. A key to enable this trust is the availability of facilities that both parties can utilize for R&D of measurement systems and their testing using surrogate material, fissile material in simple configurations, and ultimately real objects. In addition, it is equally important to have access to facilities to demonstrate and test jointly developed technology in real (or simulated) operational environments.

Of course, transparency is a much more complex and broad issue than just that with the Russians. The nature of the problem is changing significantly with the number of actors, those to which we have and do not have access, and geographic scope. It entails the traditional nuclear powers (expand all the above ideas to the P5, for example), small or nascent programs, and the cross talk between civilian and military nuclear activities. This paper does not attempt to address this broader challenge to achieve the ultimate end state of mutually assured stability.

Recommendations:

- Engage in further mutually beneficial visits to nuclear enterprise sites;
- Drive to agreement with Russia on a radiation measurement system with certified components and incorporating information barriers;
- Develop a “test-bed” to allow joint development and demonstration of measurement systems with nuclear materials;
- Develop technologies and procedures for the mid- and long-term for a systems approach to each country’s nuclear enterprise that encompasses the spectrum from material production, to component fabrication, warhead assembly, deployed and non-deployed weapons, dismantlement, and material disposition.

Appendix A – Summary of Recommendations

Recommendation 1. Engage in further mutually beneficial visits to nuclear enterprise sites.

Recommendation 2. Drive to agreement with Russia on a radiation measurement system with certified components and incorporating information barriers.

Recommendation 3. Develop a “test-bed” to allow joint development and demonstration of measurement systems with nuclear materials.

Recommendation 4. Develop technologies and procedures for the mid- and long-term for a systems approach to each country’s nuclear enterprise that encompasses the spectrum from material production, to component fabrication, warhead assembly, deployed and non-deployed weapons, dismantlement, and material disposition.

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Appendix B - Terms of Reference

UNDER SECRETARY OF STATE FOR
ARMS CONTROL AND INTERNATIONAL SECURITY
WASHINGTON

July 5, 2011

MEMORANDUM FOR THE CHAIRMAN, INTERNATIONAL SECURITY ADVISORY BOARD (ISAB)

SUBJECT: Terms of Reference – ISAB Study on Strategic Deterrence and the
Path to a World of Mutual Assured Stability

The International Security Advisory Board (ISAB) is requested to undertake a study of how the United States could manage a transition to a world of mutual assured stability.

In a world characterized by mutual assured stability, increasingly interdependent states would have incentives to cooperate on political, military, and economic issues, reducing the need for adversarial approaches to managing security challenges. Such an international security environment would facilitate significant reductions in nuclear weapons and a corresponding relaxation of nuclear force postures – in effect moving beyond traditional concepts of deterrence. This transition would be gradual unfolding across a continuum from today's deterrence-based stability to a world less reliant on nuclear weapons and characterized by increased trust and transparency among major powers. Options for the sequencing and implementation of this transition constitute the core of this study.

As the United States and Russia continue to draw down the number of their nuclear weapons, maintaining an effective and credible strategic deterrent will remain an important objective for U.S. policy. The early stages of a transition to mutual assured stability, facilitated by continued reductions in nuclear weapons, would include reliance on traditional forms of deterrence in order to dissuade potential rivals from attempting nuclear buildups. However, achieving the goal of a world without nuclear weapons would require a transition away from these traditional concepts of nuclear deterrence and assurance.

It would be of great assistance if the ISAB could examine and assess:

- The possible components of mutual assured stability and what the U.S. would need to see happening to have the confidence to consider very low numbers and, eventually, agree to the elimination of nuclear weapons;
- The development of incentives to refrain from precipitous actions and pursue cooperative and non-military solutions to international problems, even in periods of tension;
- Strategies for how the United States could manage the transition away from strategic deterrence to mutual assured stability, which would be accompanied by reductions to very low numbers of nuclear weapons, and ultimately the complete elimination of nuclear weapons;
- Whether there is tension between maintaining an effective deterrent, the requirements of assurance, and further reductions of nuclear weapons;
- What stabilizing factors, if any, might replace classical deterrence in a world of mutual assured stability; and
- Possible near term U.S. policy, force structure, and posture initiatives that would maintain strategic stability, support deterrence, and improve the long term prospects for mutual assured stability.

During its conduct of the study, the ISAB, as it deems necessary, may expand upon the tasks listed above. I request that you complete the study in 240 days. Completed work should be submitted to the ISAB Executive Directorate no later than March 16, 2012.

The Under Secretary of State for Arms Control and International Security will sponsor the study. The Assistant Secretary of State for Arms Control, Verification and Compliance will support the study. Michael Urena will serve as the Executive Secretary for the study and Chris Herrick will represent the ISAB Executive Directorate.

The study will be conducted in accordance with the provisions of P.L. 92-463, the "Federal Advisory Committee Act." If the ISAB establishes a working group to assist in its study, the working group must present its report or findings to the full ISAB for consideration in a formal meeting, prior to presenting the report or findings to the Department.



Ellen O. Tauscher

Appendix C - Members and Project Staff

Board Members

Dr. William Perry (Chairman)

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Dr. Bruce G. Blair

Mr. Joseph Cirincione

Hon. Terry Everett

Amb. Robert Gallucci

Amb. James Goodby

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